Collaboration Technology:

Commercial Capabilities, Military Needs and the IC&V Program

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DARPA ITO

Preview

- Military operations have entered a new era of uncertainty, requiring agility, rapid response, and innovative team work
- Information technology in support of adaptive teams can provide a critical discriminator for the U.S. military
- Numerous DoD programs seek to exploit such technology by:
  - using commercial products (e.g., JTF use of multi-media conferencing tools)
  - developing special purpose applications (e.g., JTF Map Server)
  _ adopting DARPA/ITO technology (e.g., ALP and Visage; JFACC and CVW)
- Commercial information technology products based on standards provide key leverage for DARPA technology transition (e.g., Java, HTML, HTTP, VRML)
- DoD information systems pipeline provides multiple insertion points for DARPA/ITO collaboration and visualization technology (e.g., JTF, JFACC, ALP, AITS, LES, COE)

Organization of Presentation

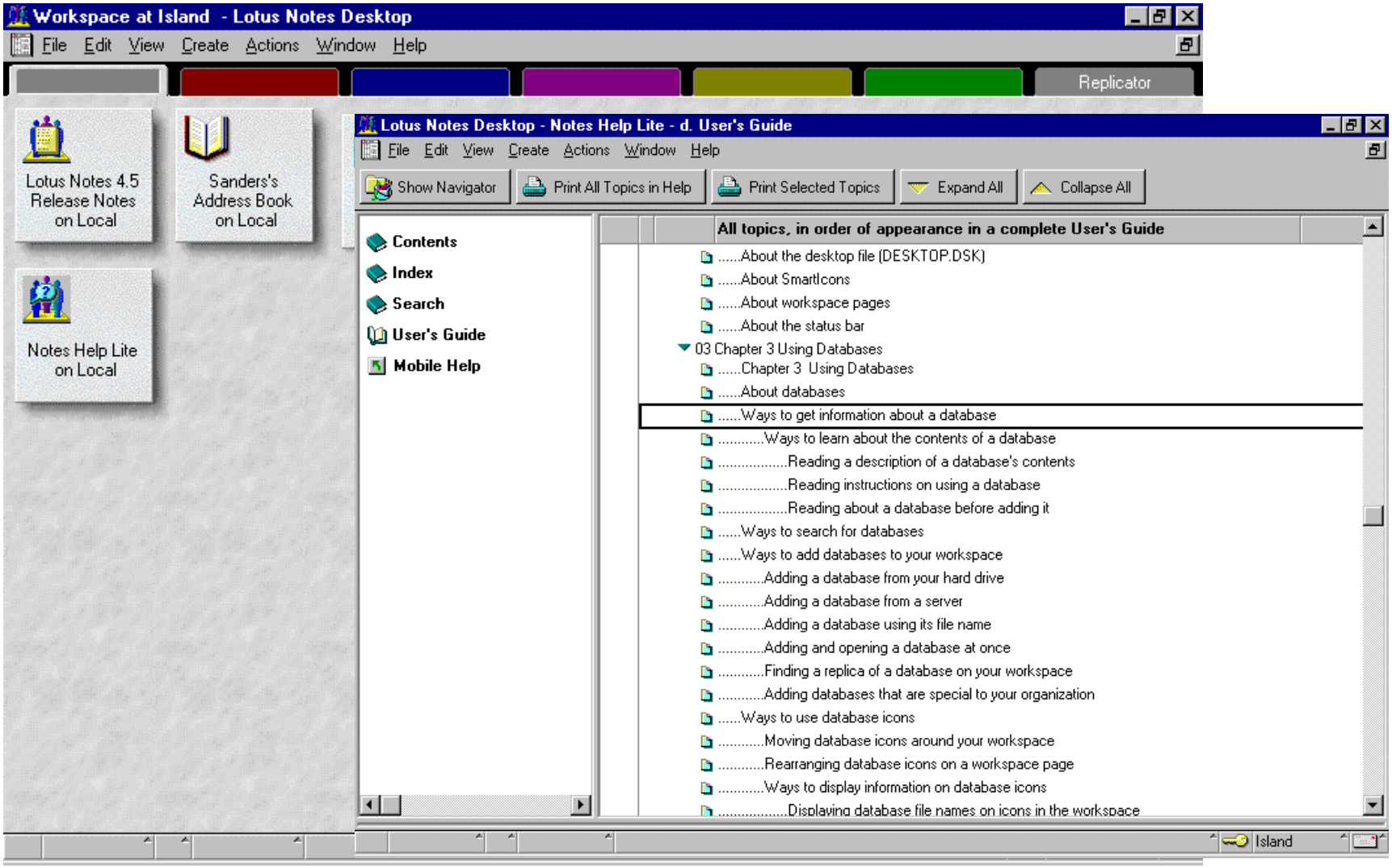
- Provide Overview of Commercial Collaboration Technology
- Describe Critical Military Needs for Collaboration Technology
- Describe How IC&V Program Addresses Military Needs and Relates to Other DARPA Projects and Commercial Developments

Overview of
Commercial Collaboration Technology

Three Categories of Commercial Collaboration Products

- Groupware
  - IBM Notes
  - Netscape Communicator
  - Microsoft Exchange
- Desktop Conferencing
  - Microsoft Net Meeting
  - Intel ProShare
- Video Conferencing
  - PictureTel
  - Compression Labs, Inc.

IBM/Lotus Notes



IBM/Lotus Notes Release 4.5

(source: textbook on Notes, literature on Notes, trial use of Notes)

Notes is a repository groupware system that enables collaboration around encrypted databases of documents, messages, and threaded discussions. Notes supports replication of documents and fields to enable disconnected use of shared documents. Automatic reconciliation of replicated documents and fields is provided in the easy cases, but manual intervention is required to synchronize the difficult cases. Notes includes a workflow scripting language that can trigger event notification via e-mail messages. Notes provides directory services among users within a Notes domain. Notes includes a fairly extensive security system that provides bi-directional authentication between clients and servers; access control to servers, databases, documents, and fields; selective encryption at the field level; and digital signatures.

Notes does not support for real-time, multi-media conferencing.

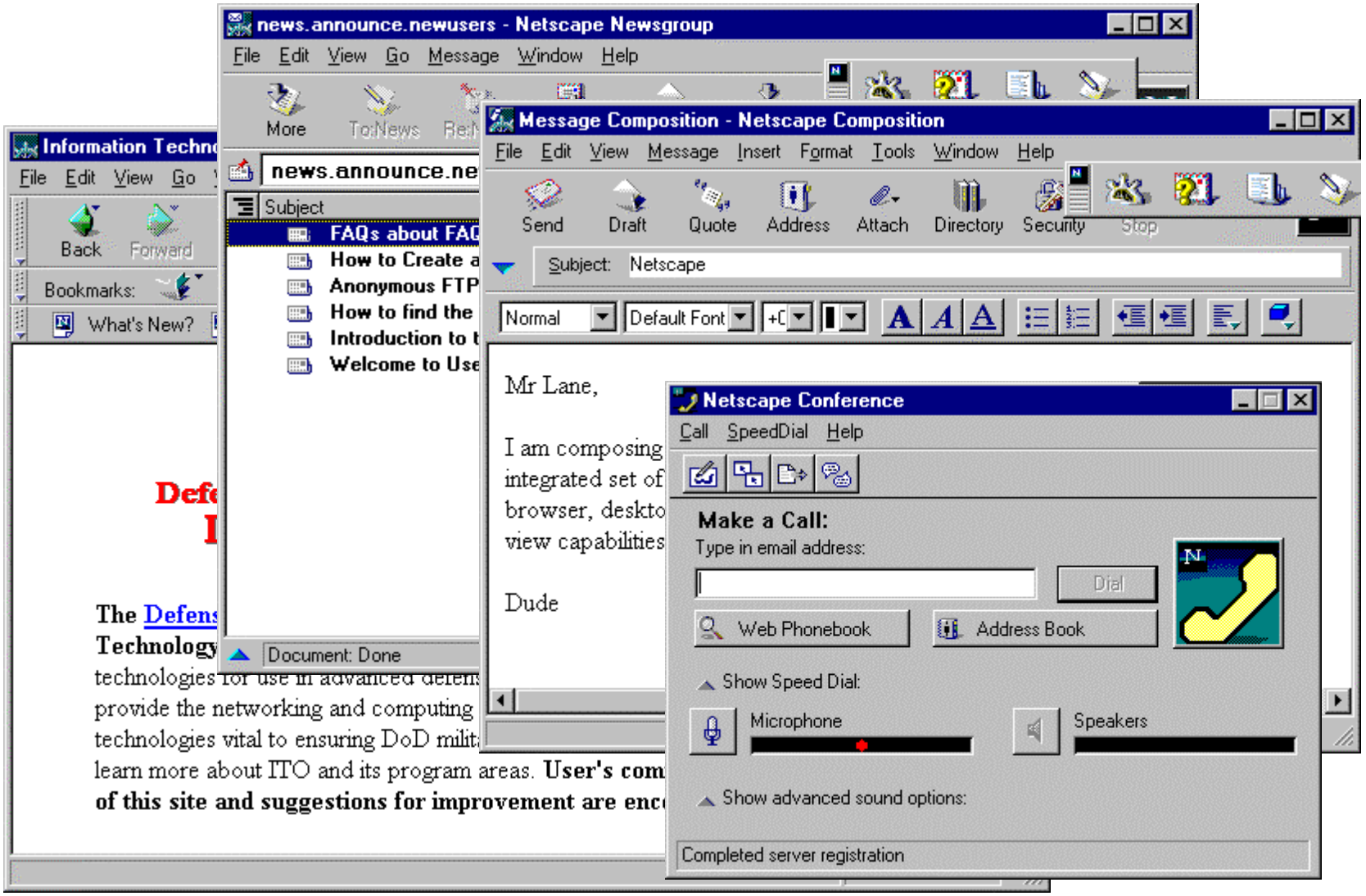
Installing the current release of the Notes client requires 50 Mbytes of disk space.

The current installed base of Notes users numbers about 3 million.

IBM/Lotus Notes Tomorrow

- Notes-browser interface to Web servers, including the use of Active X components.
- Support for "netcasting" paradigm
- Improve the ease of installation and set-up
- Integrate agents for periodic searching of web sites

Netscape Communicator



Netscape Communicator Release 1.0

(source: Netscape product brochures and trial use)

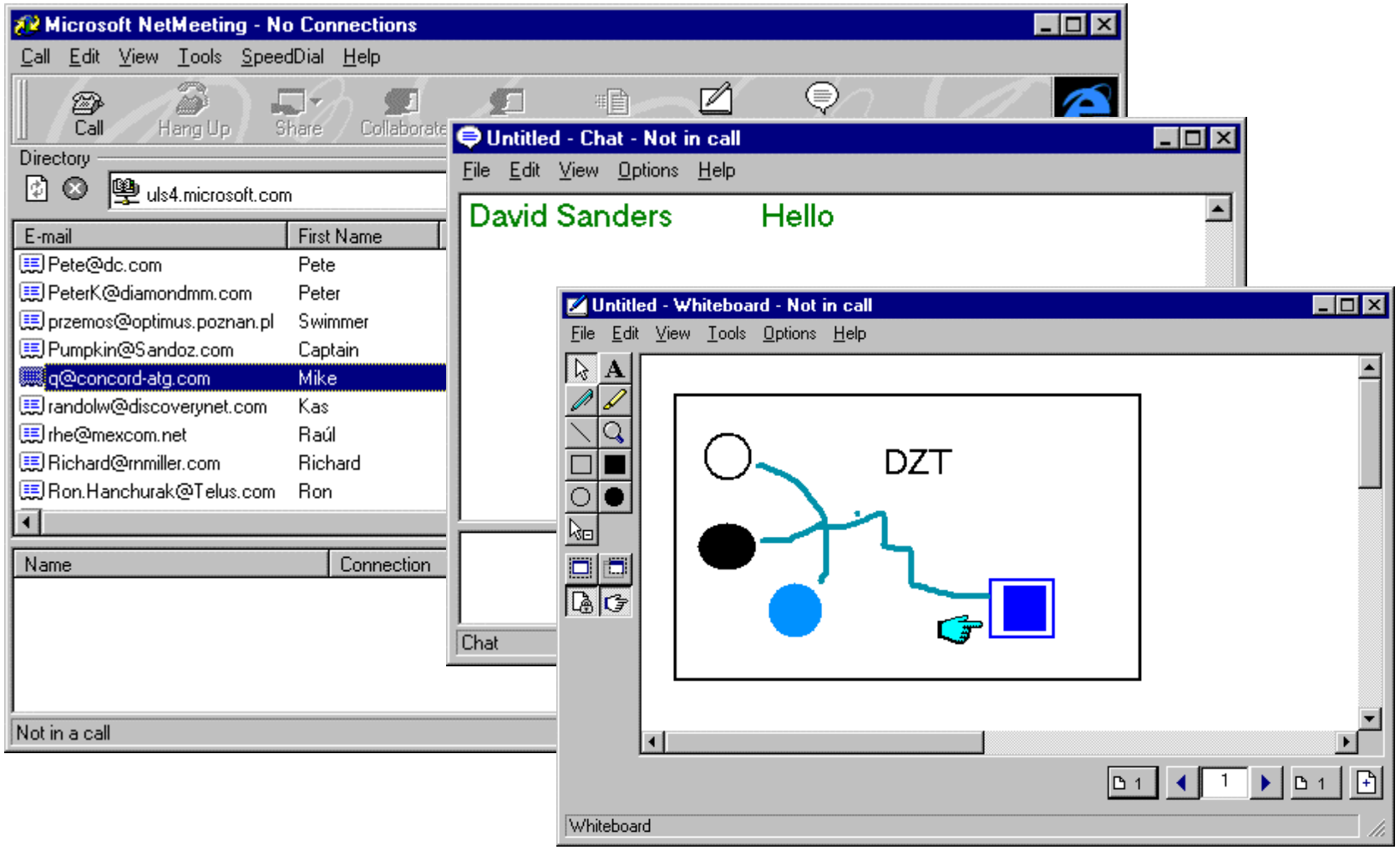
Netscape Communicator integrates open e-mail, groupware, editing, calendaring, and browsing tools into an intranet system to support corporate information sharing and easy-to-access corporate knowledge bases. Communicator comes in two editions: Standard and Professional. Netscape Communicator Standard Edition consists of 1) Navigator 4.0, an HTML browser with embedded audio/video playback and interactive 3-D graphics (VRML 2.0); 2) Composer, an HTML document editor; 3) Messenger, for rich text e-mail, encryption, directory services, and support for mobile users; 4) Conference, a real-time conferencing system (implementing the H.323 and RTP standards, where RTP is a DARPA-funded technology) that includes point-to-point audio/video, whiteboard, shared browsing, file transfer, and chat windows; 5) Collabra, a groupware server that provides discussion forums with user-structured categories, user-directed event notification, access control for private discussions, and cross-forum searching tools. Netscape Communicator Professional Edition adds: 1) a Calendar Server and 2) AutoAdmin. Communicator integrates tightly with a range of Netscape Suite Spot servers: Catalog Server, Certificate Server, Enterprise Server, Media Server, Proxy Server, and Messaging Server. Can also integrate with LiveWire Pro, an Informix Relational database product.

Netscape Communicator Tomorrow

(source: Netscape webpages)

- Real-time "netcasting" paradigm, meaning each user can automatically receive messages, applications, and updated Web site information and can customize, organize, and view it differently.
- Event notification keeps you up-to-date on critical or time-sensitive information (e.g., message alert could be displayed to inform you that a meeting room has been changed or that a competitor's new product announcement just came across the wire).
- Workspace customization with the information and applications you care about in a simple, unified environment that's built on open standards, like HTML, JavaScript, and Java.
- Remote access to your important information from any machine in any location

Microsoft NetMeeting



Microsoft NetMeeting Version 2.0

(source: briefing from product manager, Deborah Dubrow; use of beta-version; analysis of NetMeeting Web site)

Microsoft NetMeeting is a PC desktop conferencing system that provides:

1) application sharing by serializing access to Microsoft single-user appplications, such as Word, Excel, Powerpoint;

2) unencrypted, point-to-point audio/video conferencing, using H.323 standard;

3) multi-user whiteboard, text chat and file transfer, using T.120, an international standard for application sharing;

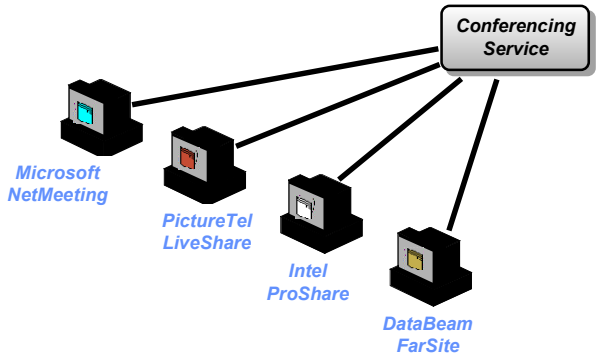
4) directory services to map names to network addresses.

User can only participate in one conference at a time. No support is provided for the conference record, nor for groupware.

Microsoft NetMeeting Tomorrow

(source: MicroSoft web pages)

- Goal is to develop Windows into a great conferencing platform, NetMeeting will be included as part of all MicroSoft operating systems.
- Embracing standards (T.120, H.320, H.323 and H.324) and extend standards (T.share).
- Provide Simple Conferencing API to allow third party developers to add conferencing support to existing applications and build value added NetMeeting add-ons or custom applications built on top of NetMeeting.
- Using directory services (proprietary and standard) to dynamically locate collaborators.
- Evaluation of relevant technologies in the conferencing and Internet space with a focus upon making them work on a large scale and with commonly available hardware.



PictureTel Concorde

PictureTel Concorde 4500

(source: briefing from and discussions with PictureTel product engineers; analysis of PictureTel product brochures; trial use of product)

PictureTel Concorde supports real-time multi-media conferencing among sites of small groups. Transfers uninterpreted, bit-images only. No explicit support for conference record, although conference can be recorded and replayed. No support for groupware. Concorde is a bandwidth intensive system, requiring 384,000 bps (3 ISDN connections) to achieve 30 fps video, but can achieve 15 fps at only 128,000 bps (1 ISDN connection). Coast-to-coast cost for 3 ISDN connections is about $60 per hour. Although used primarily for site-to-site videoconferences, Concorde can be used for multi-site conferences, but requires the configuration of multi-point control units to bridge sites, where each site must be connected using the same bandwidth; thus, multi-site conferences devolve to the lowest common bandwidth available among the participating sites. PictureTel is extending the range of functionality in Concorde through the addition of peripherals. GroupView adds overhead projectors, remote document displays, and a special stylus for whiteboard-style annotation. GroupShare provides software that allows desktop conferences between PCs which can be plugged into PictureTel systems and can steal bandwidth from the videoconference (that is, freeze the video during the transfer of desktop conferencing data). Videoconferencing Gateways are available for transcoding between some standard video encoding formats.

PictureTel Tomorrow

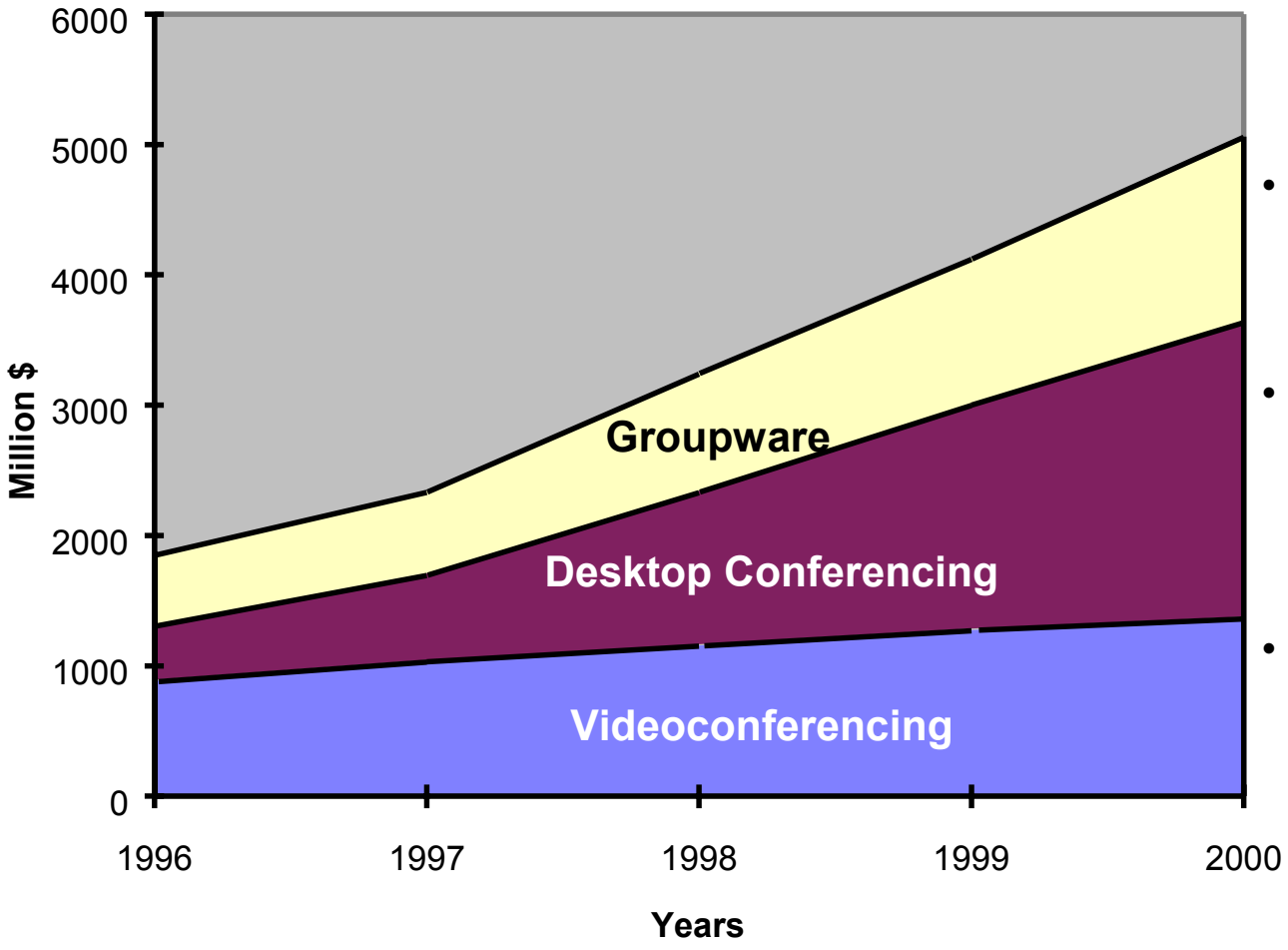
(source: PictureTel Federal marketing manager)

- PictureTel mission is to provide business quality graphics (not broadbased consumer quality).
- Desktop VideoConferencing -- Anywhere Now
  - TCP/IP, LAN and Packet Switched Telephone Network
  - a hardware assisted pc will be able to have videoteleconference in the office (LAN), at home (ISDN) and on the road (PSTN)
  - adding support to control peripherals (cameras and microphones)
  - increasing video quality at lower bandwidth
- Room size video-conferencing
  - switch to toggle from WAN (H.320) to TCP/IP (H.323)
  - improved higher quality audio at lower bandwidth, voice activated cameras
  - group whiteboards and secondary monitor and overhead displays
  - H.331 Satellite Broadcast compatibility
- Challenges: service guarantees over TCP/IP, firewall access

Market Growth Drivers for Collaboration Products

- Falling Cost
  - Competitively priced, standards-based, groupware for the desktop
  - Price drops for desktop add-ins, such as cameras and speakers
  - Higher levels of silicon integration will reduce component count
  - Basic functions standard in desktop systems (codecs, speakers, mikes, modems)
  - Increase in horsepower of CPUs and the elegance of software codecs
- Increasing Performance
  - Web-based access to groupware applications
  - Integration of desktop conferencing systems with groupware
  - Improvements in silicon, advances in algorithms to implement standards for video and audio encoding
- Growing Infrastructure
  - Browser-related standards, such as Java, HTML, HTTP, and VRML
  - Low-cost high speed modems (maybe up to 56Kbps) and H.324 for POTS
  - Movement toward switched ATM LANs and CATV as access method
  - Universal acceptance of T.120 data conferencing standard

Projected Global Market for Collaboration Products



- **Turning Web into a groupware environment**
- **Turning PC into a videoconferencing system**
- **Lowering cost of group video-conferencing systems**

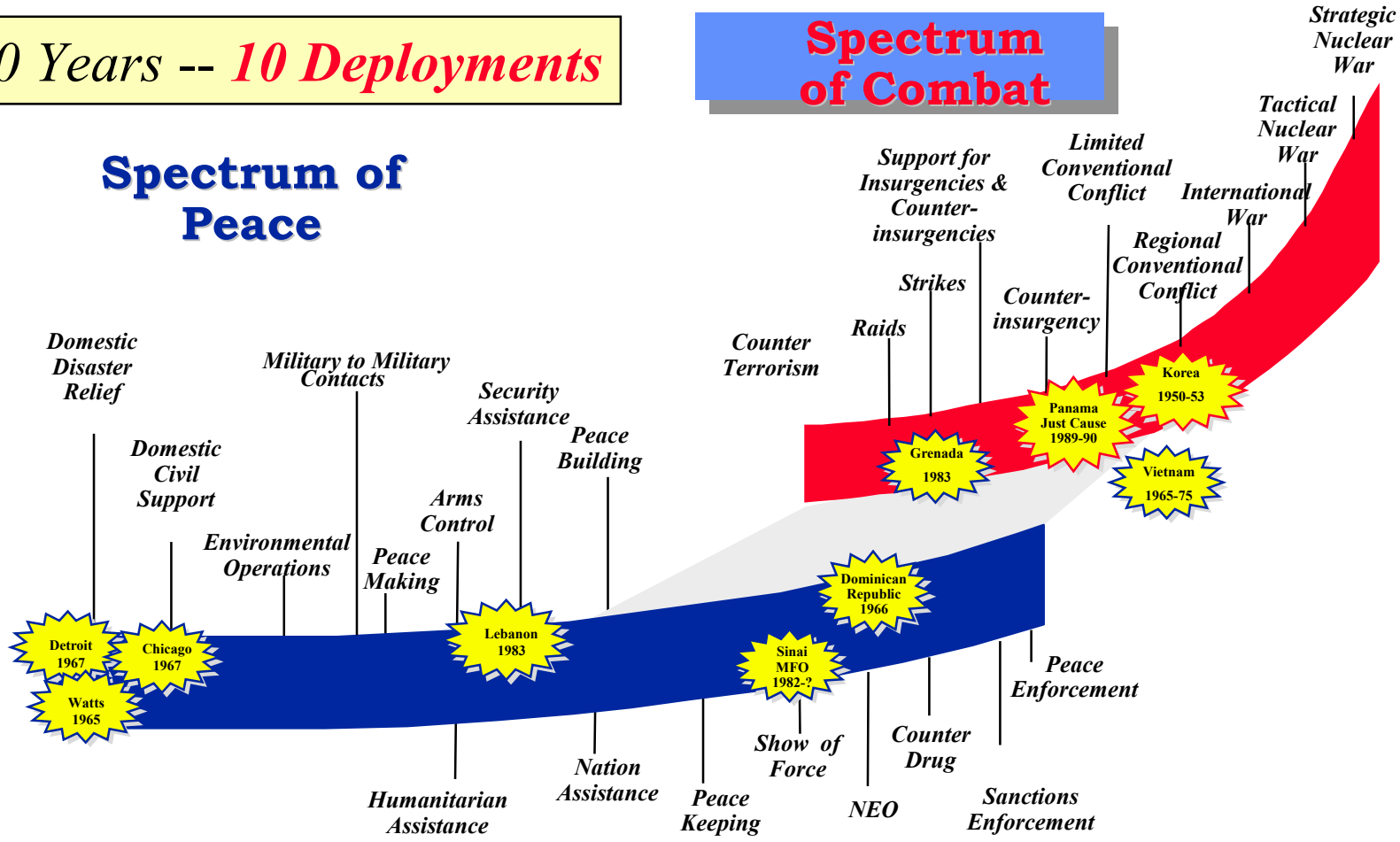
Sources: Forward Concepts - Electronics Market Research
Data Communications - Market Forecast

Critical Military Needs for Collaboration Technology :

A New Era for Military Operations

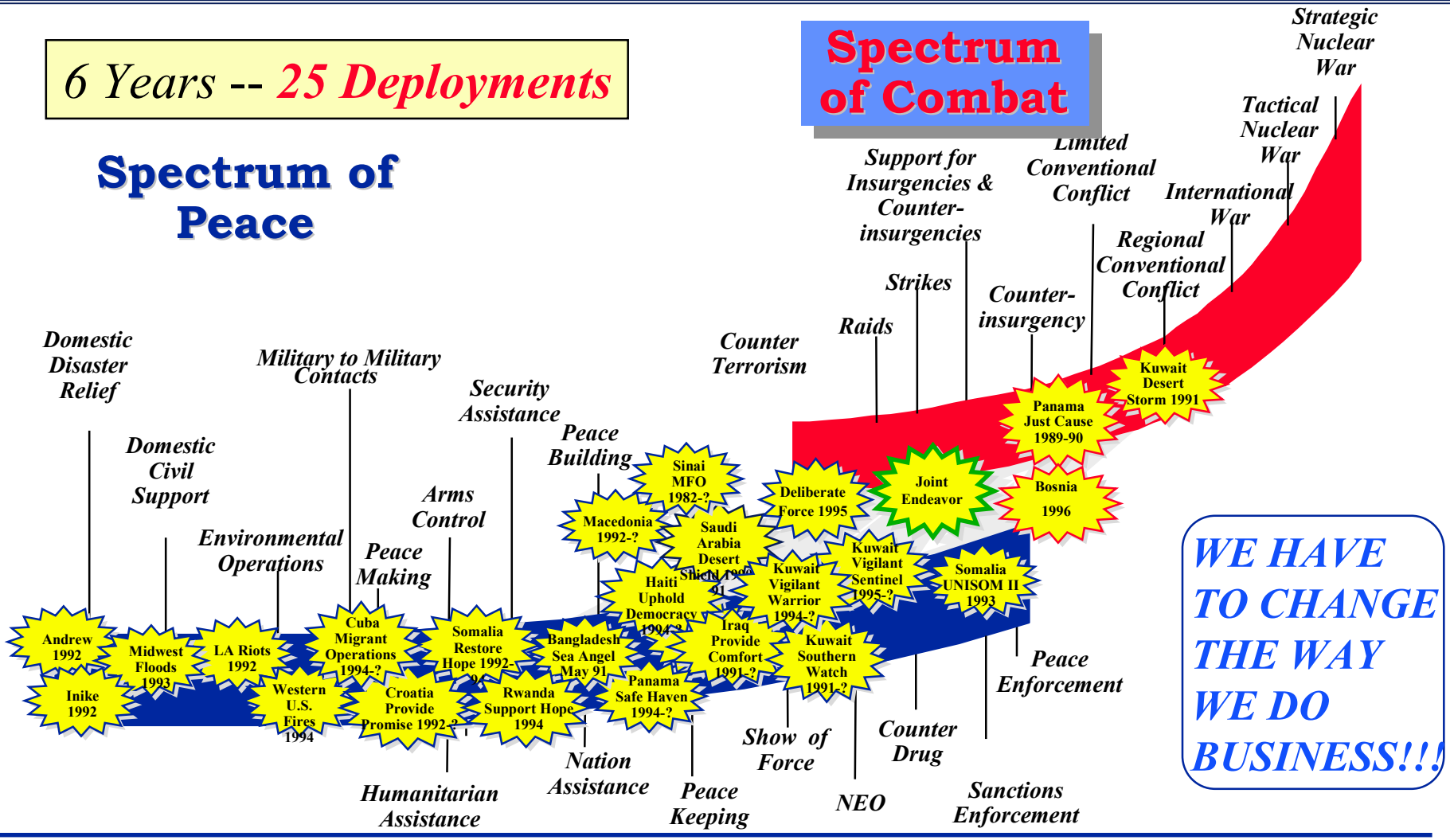
Spectrum of Military Operations 1950-1989

40 Years -- 10 Deployments



Spectrum of Military Operations 1990-1996

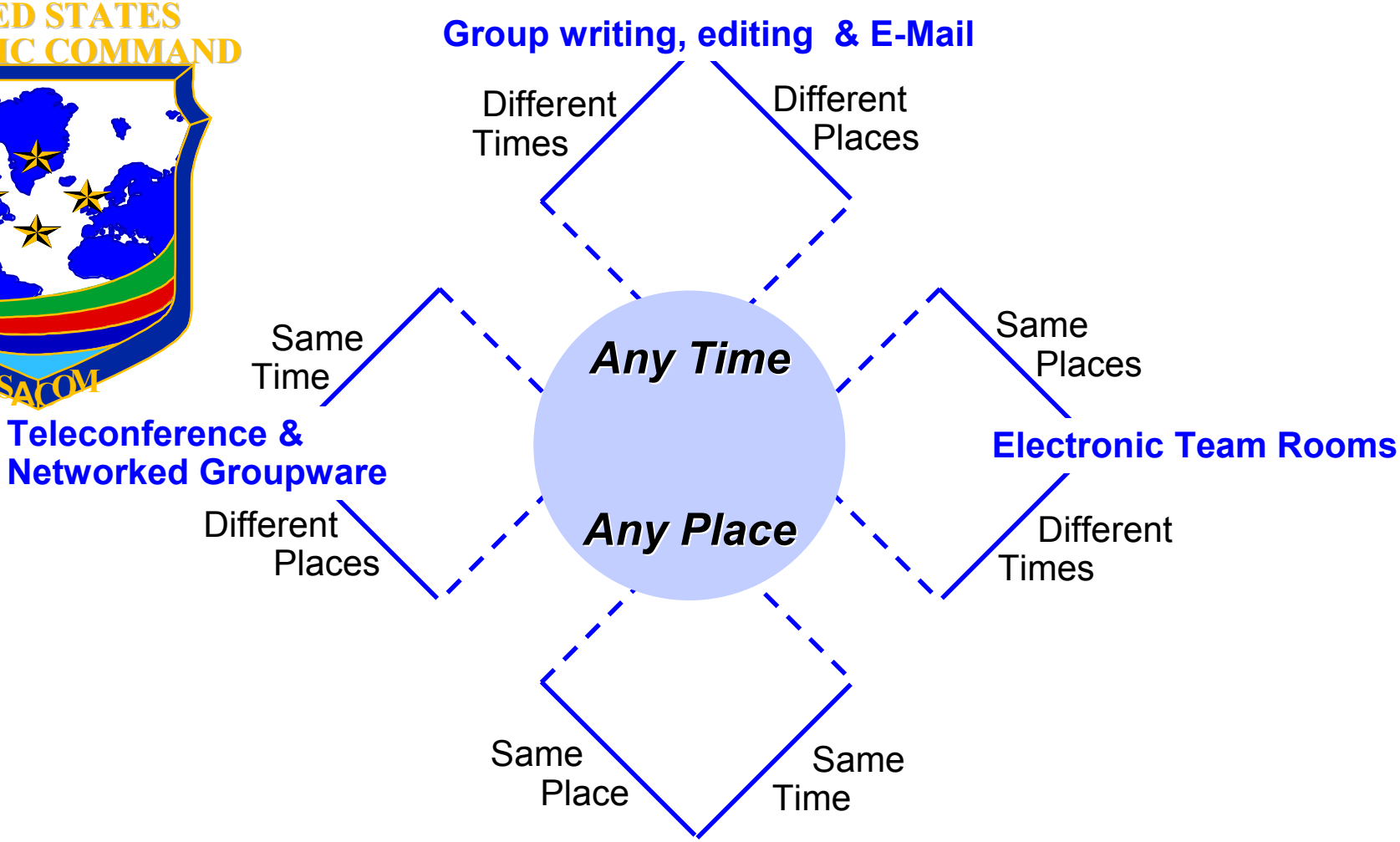
6 Years -- 25 Deployments



WE HAVE TO CHANGE THE WAY WE DO BUSINESS!!!

Advanced Joint Planning

UNITED STATES ATLANTIC COMMAND



Source: Adapted from the Institute for the Future

Advanced Joint Planning ACTD

(source: AJP PAD and USACOM briefing to Collective Action Tools workshop, April 1996)

Goals: develop CINC level readiness management and deployment planning tools, incorporating operator supported concept of operations; develop effective, deployable courses of action in days rather than weeks. (Program ends in FY 98)

Tasks: 1) develop next revision of Joint Readiness Management System, Joint Planning Execution Tools, and Map-Based Planning; 2) integrate these into a system.

Customer: USACOM

ACOM has identified collaboration technology as key to quickly convening a virtual team, considering and evaluating courses of action, and planning for operations.

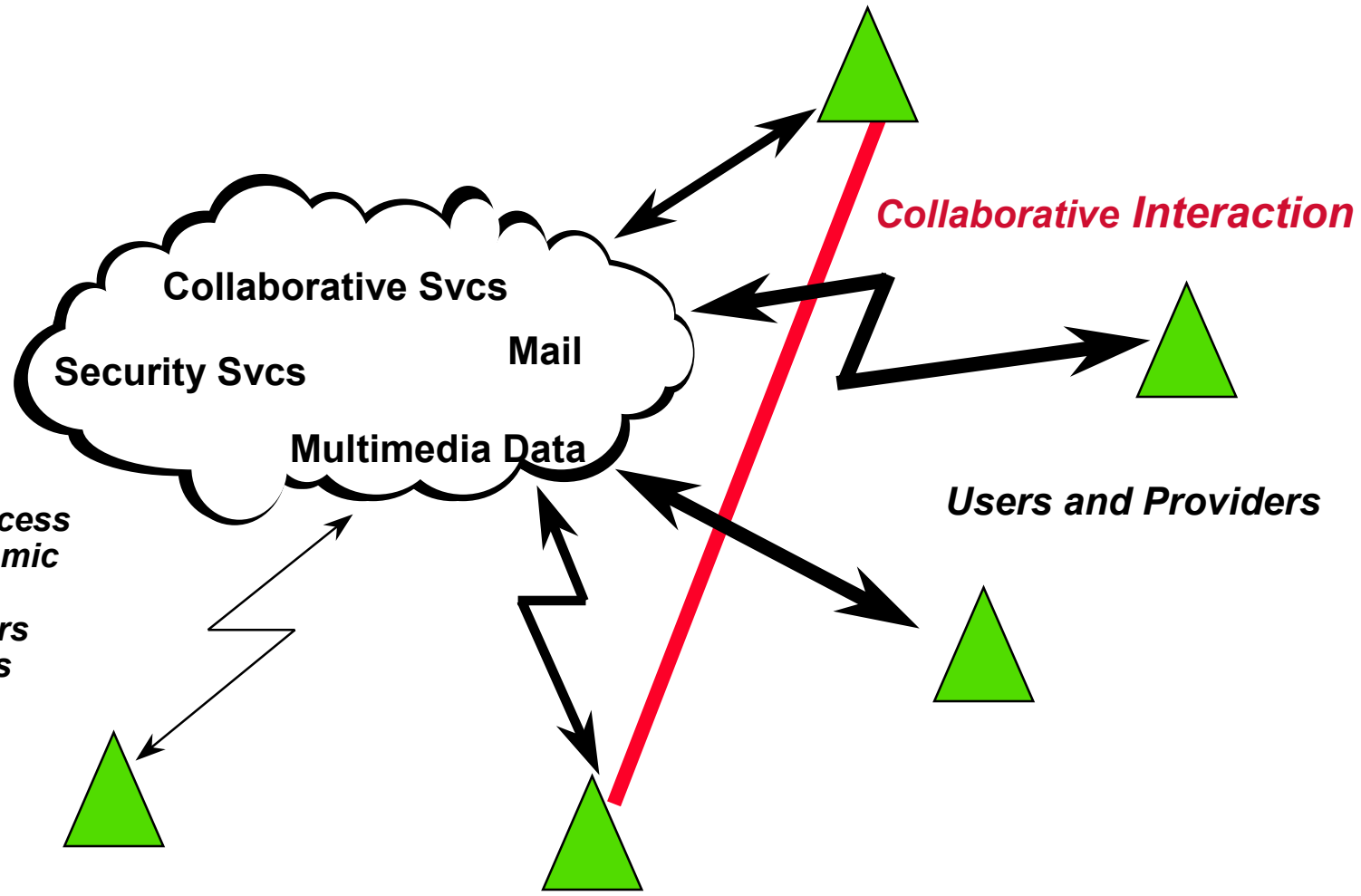
ACOM intends to evaluate and use commercially available collaboration technology, but has identified a number of collaboration challenges that current commercial technology can not meet.

US Atlantic Command Needs

(ACOM presentation to Collective Action Tools Workshop, April 1996)

- Provide the capability to collectively define process to fit a crisis situation and then to modify that process on the fly in response to changing task and situation (Adaptive Team Dynamics)
- Provide a system to supervise and advise about crisis workflow (Adaptive Team Dynamics)
- Provide the ability for virtual teams, both intra-organizational and inter-organizational, to be quickly established and changed (Adaptive Session Management & Task-based Collaborator Discovery)
- Provide notification of significant events (Situation-Relevant Retrieval)
- Enable distributed team members to share views and to maintain their own views (Active, Role-based Views)

US Intelligence Community Intelink Program



Intelink

Data & Services

- *http-based*
  - *web DB access*
  - *static/dynamic web pages*
- *streaming servers*
- *security services*
- *others*

Intelink Program

(source: Coordination and Collaboration Tools Working Group workshop, September, 1996)

Cooperative network among the intelligence analysis community to enable more effective collaboration and productivity. Includes NIMA, CIA, NSA, DIA, and other relevant components, services, and agencies.

Using intranet technology, coupled with desktop conferencing products, such as Insoft Communique, to facilitate collaboration among intelligence analysts. Initial focus appears to be on imagery analysis.

Intelink provides an interesting collaboration testbed, and also has identified some needs not currently available from commercial collaboration technology.

US Intelligence Community Needs

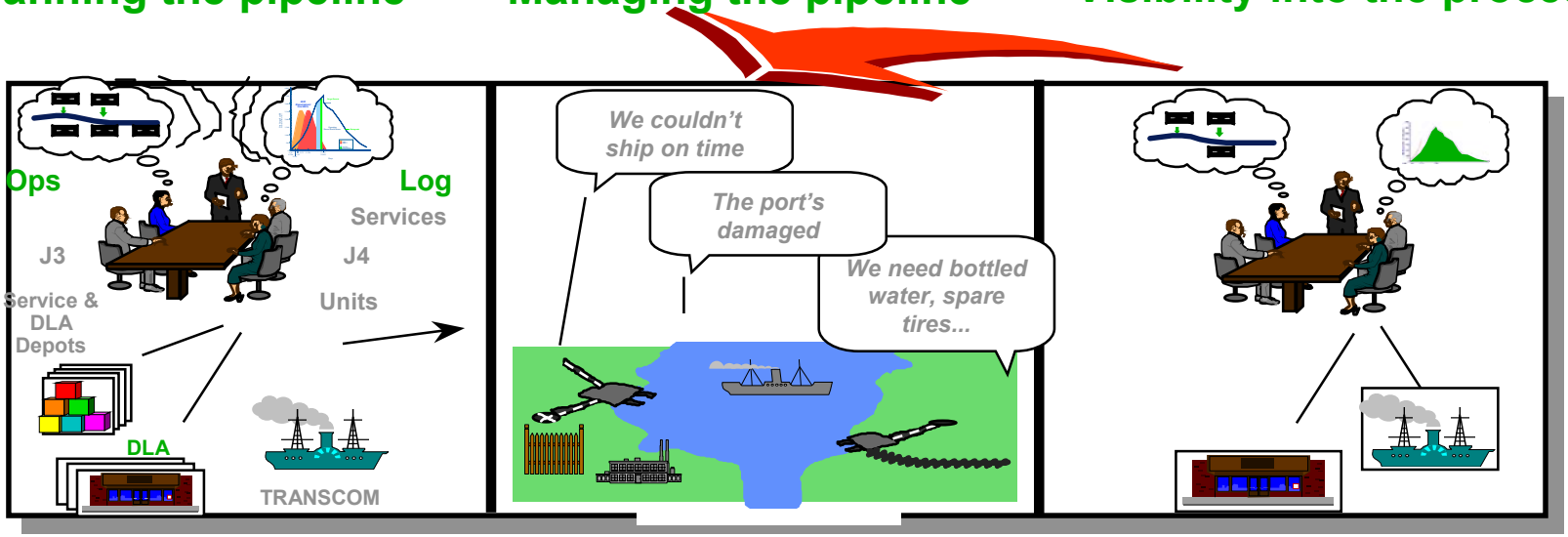
(ISX Intelligence Domain Analysis Report; presentation to Collective Action Tools Workshop, April 1996)

- Need to capture and propagate the task context throughout the information production process (Situation-Relevant Retrieval)
- Need ability to capture, explicity represent and view reasoning used to arrive at conclusions in intelligence analysis (Situation-Relevant Retrieval)
- Need to bring together appropriate expertise and information rapidly enough to produce timely assessments (Task-based Collaborator Discovery)
- Need the ability to quickly determine which users need information products and who is or will be producing the needed information (Adaptive Team Dynamics)
- Need faster “spin-up”time for rotating and traveling analysts (Situation-Relevant Retrieval)

Logistics Planning and Execution
Advanced Logistics Program

Overarching issue: Logistical control

Planning the pipeline – Managing the pipeline – Visibility into the process



Develop Plan

- *Collaboratively analyze tradeoffs of multiple Logistics COAs*
- *Globally optimize*
- *Executable detail*

Monitor Execution

- *Detect plan deviation*
- *Identify affected plan components*
- *Notify key players*
- *Execute IAW Plan*
- *Manage flow*
- *Create plan sentinels*

Replan

- *Redirected flow*
- *Locally optimal fixes*
- *Done in time to matter*

In-Storage In-Process In-Transit In-Theater

Advanced Logistics Program

(source: ALP PAD and discussions with Brian Sharkey)

Joint DARPA/DLA program.

Objective: develop and demonstrate software tools and protocols needed to gain control of the logistics pipeline and enable the warfighter to project and sustain overwhelming combat power sooner.

Approach: develop information manipulation and planning tools that can tightly couple continuous planning and execution monitoring across operations (J3), logistics (J4), DLA, and TRANSCOM. Key Technology: "sentinels" that understand logistics application domain and that monitor execution data, detect deviations, and trigger replanning.

Products: 1) tools to track assets and make smarter use of lift, 2) rapid supply services, 3) force sustainment planning and sourcing, 4) logistics courses of action feasibility planning.

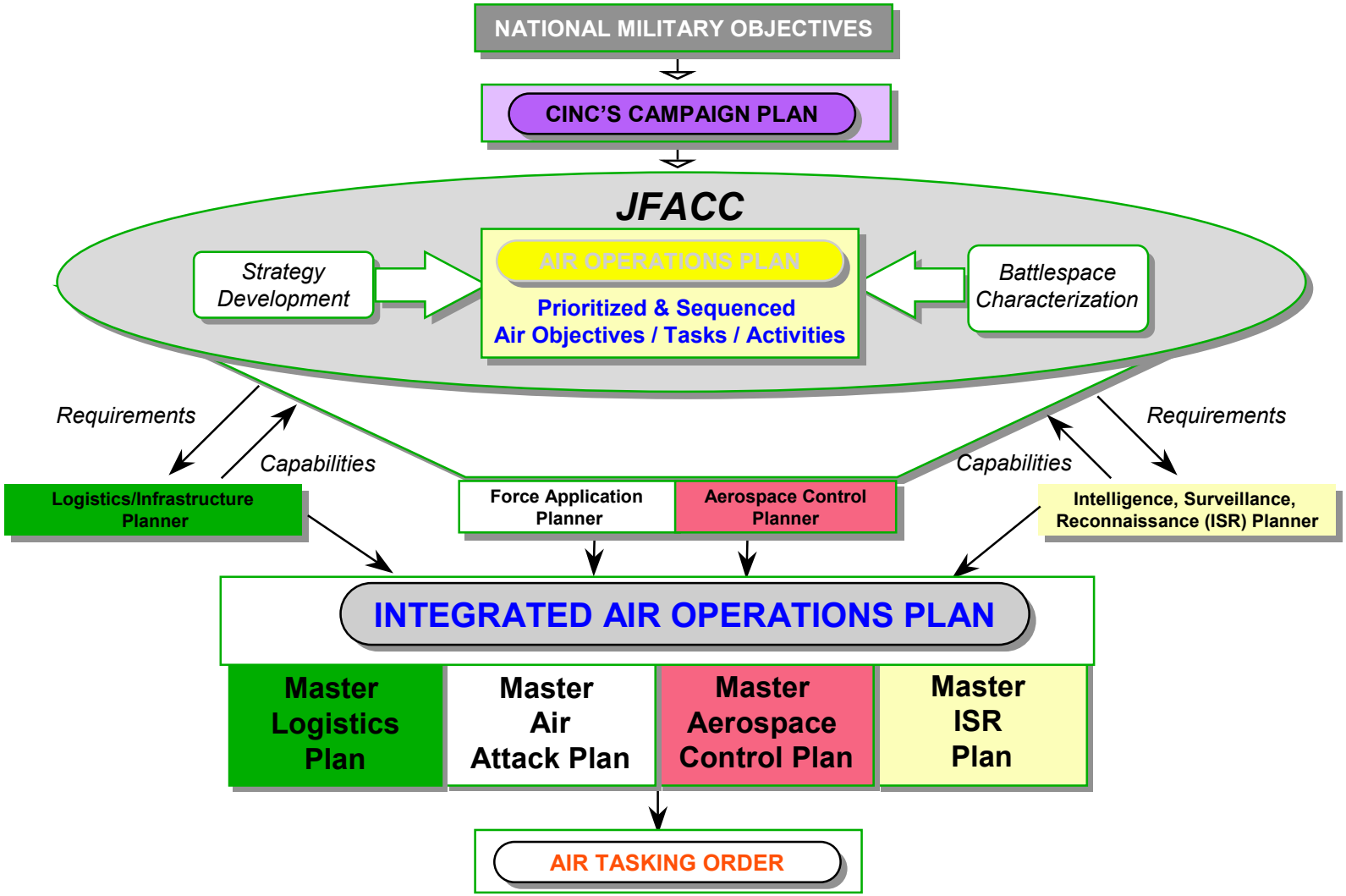
IFDs: 7/97, 8/98, 9/99, 6/00, 8/01

Advanced Logistics Program Needs

(ALP Design Document ver 3.0, November 1996)

- Need the ability to jointly compare assessments from different viewpoints (Active, Role-Base Views)
- Need the ability to collaborate laterally across communities that have dissimilar platforms, different in access portals, and variations in bandwidth availability (Adaptive Session Management)
- Need to rapidly mobilize, deploy, and sustain operations dictates that logistics must perform with optimum efficiency and flexibility (Adaptive Team Dynamics)
- Need the ability to locate units with the capabilities to satisfy the tasks, specified or implied, presented by the mission (Task-based Collaborator Discovery)
- Need to provide users with a explanation and rationale when a change occurs (Situation-Relevant Retrieval)

Air Campaign Planning
JFACC Program



JFACC Program

(source: JFACC PAD and briefing from F.T. Case at ISO Architecture IPT Off-Site)

Goals: reponsiveness, resource efficiency, campaign effectiveness, process flexibility

Objectives: 1) create air tasking order in hours/minutes instead of days, 2) prosecute high-priority targets in seconds/minutes instead of minutes/hours, 3) reduce in-theater Air Operations Center footprint from more than 1000 to less than 100 (exploit high bandwidth networks and collaboration technology), 4) increase mission cost-effectiveness by a factor of 10, 5) reduce by 50% sorties cancelled/delayed, 6) shorten air campaign phases by up to 50%, 7) reduction of time required to establish a JFACC environment for a particular theater/contingency from weeks to days, and 8) extension of JFACC capabilities to integrated Command and Control for maritime and ground forces. Some key tasks related to ITO IC&V program:

Task 02 - Workflow Management and Collaboration: develop and transition technology for managing workflow processes comprising distributed human and software agents. Quickly establish focused, virtual planning teams supported by data and application sharing.

Task 03 - Migrate JFACC technologies to land and sea command and control systems.

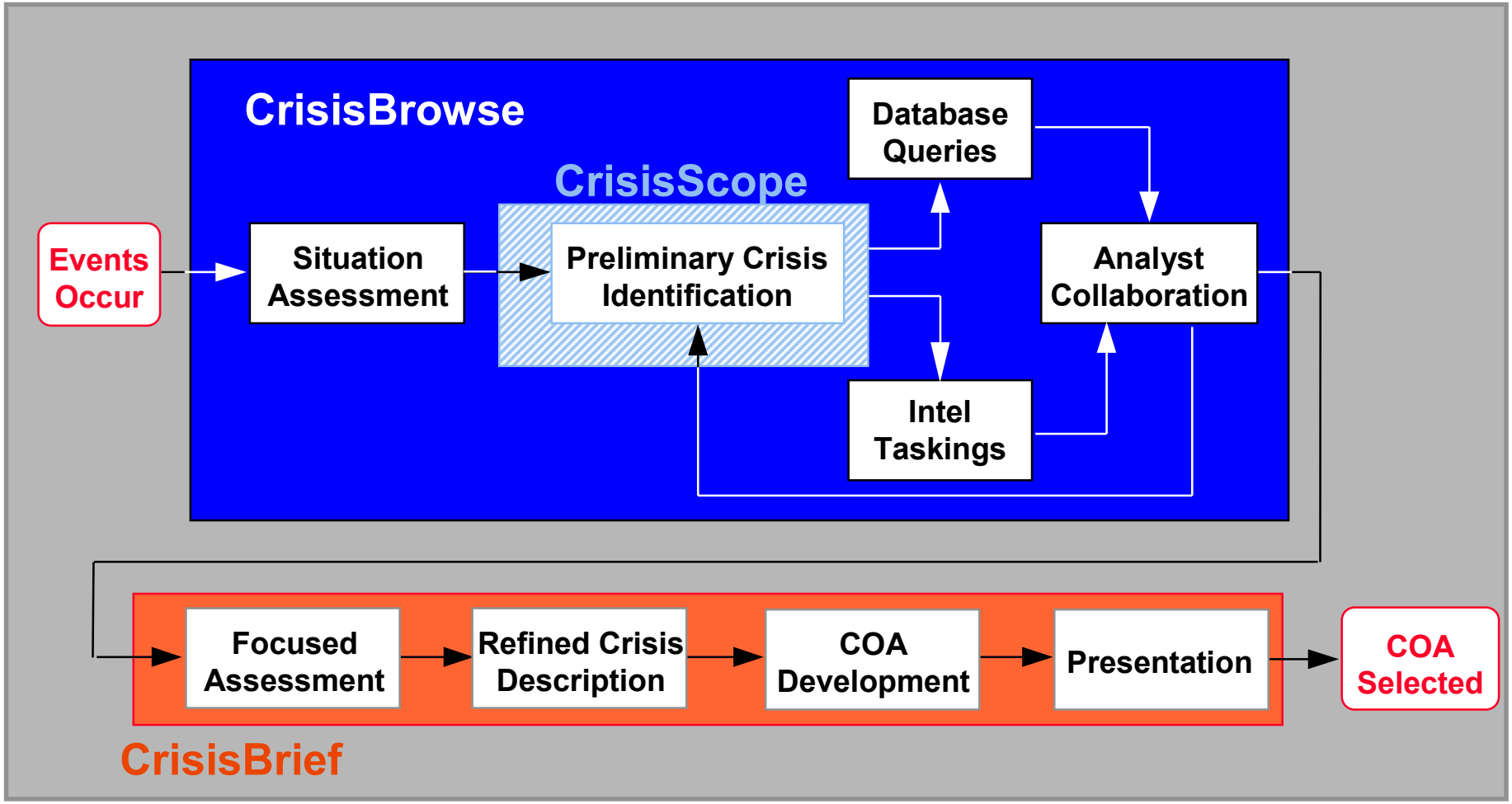
JFACC Needs

(JFACC presentation to Collective Action Tools Workshop, April 1996)

- JFACC after next must operate in a highly dynamic, distributed environment and will need to resolve contention for resources (Adaptive Session Management)
- Expertise for all aspects of campaign management will come from distributed functional experts (Task-based Collaborator Discovery)
- Integration of expert capabilities is critical to effective development of plans (Active, Role-based Views)
- Management of experts in will be necessary to achieve objectives within time and resource constraints (Situation-Relevant Retrieval)
- JFACC program will focus primarily on content of interactions rather than on management of collaboration (Adaptive Session Management and Adaptive Team Dynamics)

Crisis Understanding and Mitigation
GENOA Program

CrisisNet



GENOA Program

(source: AJP PAD, Genoa BAA, and discussions with Brian Sharkey)

Customers: National Security Council and National Military Command Center

Goal: Filter, organize, and interpret unstructured data from many sources in order to detect and avert nascent crises.

Objective: Develop, demonstrate, and transition the tools and systems necessary to recognize, understand, forecast, and develop options to defuse potential crisis situations in hours by reducing the time to form teams, analyze crisis data, and develop brief options for responses.

Tasks: Crisis Net - implement system networks, software, and hardware to enable distributed resources and users to interact and share data; Crisis Browse - provide seamless access to search, monitor, and display crisis-relevant data from hundreds of heterogeneous databases in minutes and eliminate team formation time completely through the use of collaborative tools that allow constant virtual crisis monitoring and management via trigger event monitoring; Crisis Scope and Crisis Brief - rapidly determine and evaluate courses of action.

Strategy: use Intelink as a framework and extend.

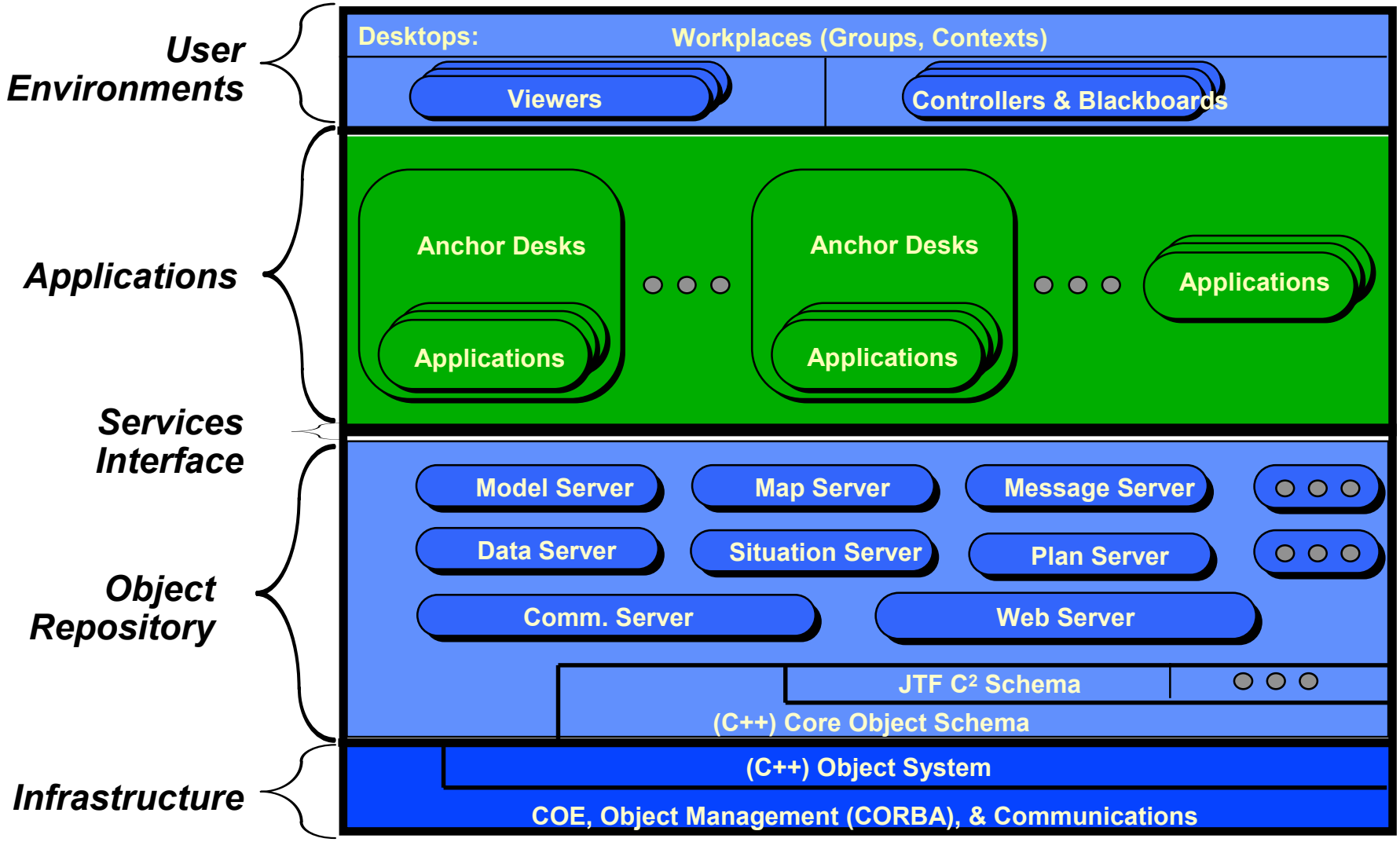
Some Key Milestones: Demo Crisis Brief 3 Q 98; IOC Crisis Model 2 Q 99; IOC Data Browse 2 Q 99

GENOA Needs

(ISO presentation to IC&V PI Meeting, October 1996)

- Need to link human resources and data (Task-based Collaborator Discovery)
- Need to rapidly form and support Ad Hoc crisis action teams (Adaptive Team Dynamics)
- Need to record the processes so that they can be analyzed and reused when similar problems occur in the future (Situation-Relevant Retrieval)

Joint Forces Command and Control
JTF ATD



JTF ATD

(source: AJP PAD; briefing from BBN, JTF support contractor, briefings by John Schill and Rick Hayes-Roth)

Customer: USPACOM Goals: develop a rapid CJTF crisis response capability that can be established and operational in days; provide collaborative planning tools to enable development of integrated, executable operations plans in hours; provide en route planning and execution management for the JTF staff; provide a software reference architecture that links the National Command Authority, CINCs, JTF, components, and the Defense Information Infrastructure and that enables rapid tailoring of the operational environments; provide common servers and an application suite; migrate to the Defense Information Infrastructure. Tasks: 1) extend JTF reference architecture to support security, additional COTS Object Request Brokers (including Microsoft Object Linking and Embedding) and office simulation and battlefield awareness functions; 2) integrate and demonstrate JTF ATDs and demonstrate portability between CORBA and OLE and accommodate Java standards; 3) develop Nuclear, Biological, and Chemical and Disaster Information anchor desks and provide workflow persistent briefing development tools; 4) extend capability of the Map and bandwidth optimization capabilities with additional servers, such as security, schema, and event servers; 5) implement simulation and visualization tools that enable a user to fight and train from the same seat; and 6) transition to the Global Command and Control System. Selected Milestones: add OLE ORB 2Q97, develop Java program to edit plans 2Q97, demo semantic interoperability between several applications 4Q97, develop bandwidth adaptive servers 4Q97, develop adaptive workflow 2Q98, develop self-updating brief 2Q98, demo bandwidth adaptive, object-based distribution and sharing 4Q98, demo Intel anchor desk 2Q99, demo plan visualization software 2Q99, demo rapid deployment of specialize plan viewers 4Q99, demo optimization of workflow in resource limited context 4Q00

Joint Task Force Needs

(JTF presentation to Collective Action Tools Workshop, April 1996)

- Need to maintain audit trail between tasks, decision sequence, rationale, and tie back to parent objectives (Situation-Relevant Retrieval)
- Need support for Ad Hoc group formation based on expertise (Task-based Collaborator Discovery)

Summary of Critical Military Collaboration Needs

	ACOM	Intel	ALP	JFACC	GENOA	JTF
Adaptive Session Management	✓		✓	✓		
Task-based Collaborator Discovery	✓	✓	✓	✓	✓	✓
Situation-Relevant Retrieval	✓	✓	✓	✓	✓	✓
Adaptive Team Dynamics	✓	✓	✓	✓	✓	
Active, Role-Based Views	✓		✓	✓		

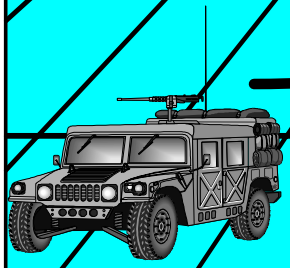
ITO IC&V Program

Vision for Adaptive Session Management

ADAPT SESSION ENCODING BASED ON TASK, ACCESS PORTAL, BANDWIDTH

ADAPT OBJECT PLACEMENT BASED ON TASK, BANDWIDTH, COMPUTATION

ALLOCATE SESSION RESOURCES BASED ON TASK, BANDWIDTH, CONNECTIVITY



Adaptive Session Management

- Focus of commercial development
  - standards among non-adaptive hardware devices
  - video gateways to translate encodings between various standards
  - priority pre-emption of bandwidth based on user initiated requests
- Focus of other DARPA programs
  - bandwidth allocation between applications using an economic model based on tokens (JTF)
  - point-to-point adaptation of protocol, display transcoding, and security using proxies (GloMo)
- Focus of IC&V program
  - automatic, multi-point adaptation of resources (session bandwidth, display trancoding, and object placement) within a multi-user session based on task, resource availability, connectivity, and access portal

Technology for Adaptive Session Management

Team Applications

Task State Changes

Task State Model

Session Management Knowledge

Session Adaptation Engine

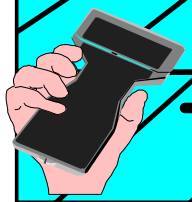
Distributed Session Adaptation Protocol

Session State Changes

Session State Model

Object Move Requests
Proxy Allocation Requests
Bandwidth Allocation Requests

Quorum Monitoring & Control Services

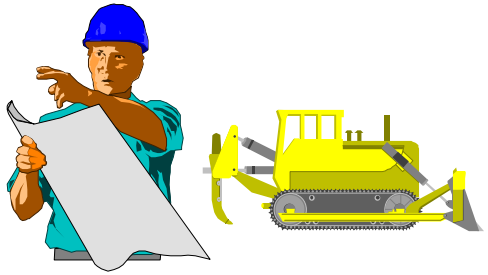


Vision for Task-based Collaborator Discovery

Logistics analysts in CONUS planning movement of fuel into theater.

Will they connect in time to prevent arriving fuel from overrunning storage capacity?

Construction engineers in forward base overseeing construction of fuel storage depot.



TEAMS SHOULD BE ABLE TO DISCOVER EACH OTHER IN REAL-TIME DURING THEIR TASKS IN ORDER TO SHARE VIEWS, INFORMATION, AND EXPERTISE

Intelligence analysts in CONUS assessing road infrastructure in operations area to assess bomb damage.

Will they connect in time to discover their disagreement over the condition of critical bridges?

Logistics analysts in theater assessing road infrastructure in operations area to plan materiel movement for forward advance.

Task-Based Collaborator Discovery

- Focus of commercial development (user browsing)
  - web-based search engines combined with meta-data representation
  - user-searchable distributed directory services
- Focus of other DARPA programs (communities of interest)
  - creation of shared, multi-user workspaces based on shared-interest communities (CAETI, JFACC from IC&V)
- Focus of IC&V program (real-time, task-based discovery)
  - monitor and model user's task-based interests in real-time
  - compare and contrast a user's task-based interest model against the interest models of other users
  - notify potential collaborators about possibly effective matches

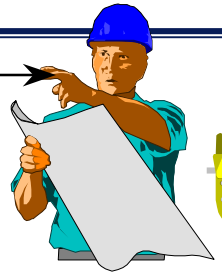
Technology for Task-based Collaborator Discovery

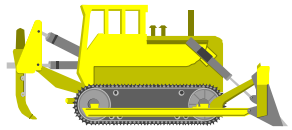
Interest Graph Builder

Graph Matcher

Local Interest Graph

Interest Graph Builder





Local Interest Graph

Graph Matcher

Graph Matcher

Local Interest Graph

Semantic Multicast

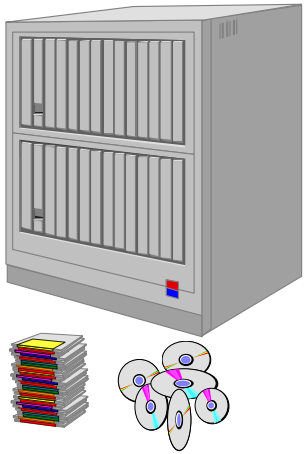
Local Interest Graph

Graph Matcher

Interest Graph Builder

Interest Graph Builder

Vision for Situation-Relevant Retrieval



Record informal collaborations in multimedia archive and provide semantic query access to that archive.

Why did we move the operation start date ahead by two weeks?

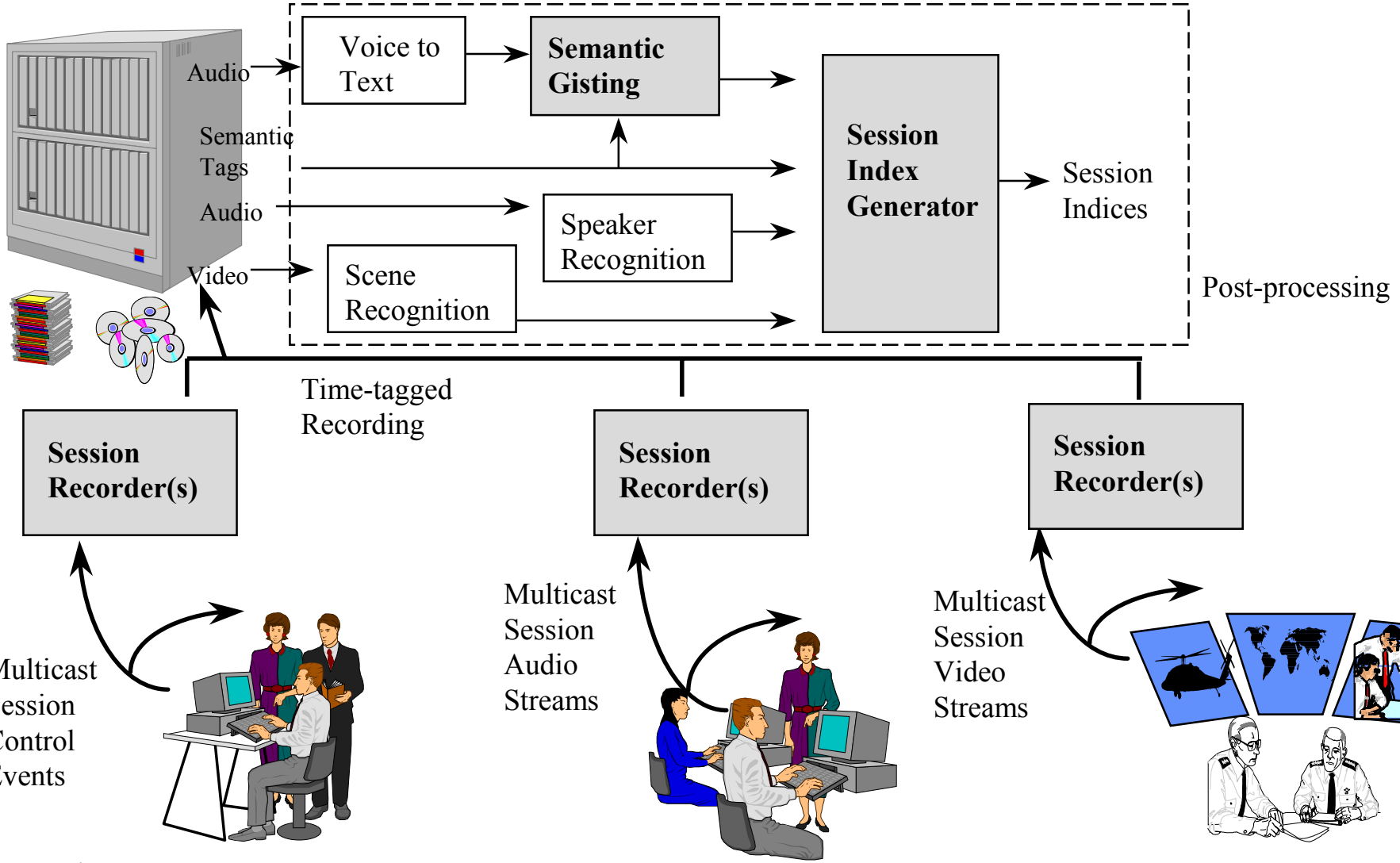
Who was present when we discussed the bridges in southern Iraq?

Did the air campaign planners discuss the use of French aircraft to screen American supply ships?

Situation-Relevant Retrieval

- Focus of commercial development
  - represent threaded discussions through user provided semantic tags
  - link shared artifacts together through compound documents and hyperlinks
  - annotate compound documents with multiple media notes
  - exploit searchable webs based on text extraction and meta-data
- Focus of other DARPA programs
  - create application-specific, distributed object webs (JTF, JFACC)
  - search across multiple, heterogeneous databases (I*3)
  - develop common command and control domain schema (ISO cross-program architecture initiative)
  - enable translingual search of text repositories (ITO IM)
- Focus of IC&V program
  - capture informal collaborations in multiple media
  - capture session semantic events
  - create rich semantic indices of multi-media archives

Technology for Situation-Relevant Retrieval



Vision for Adaptive Team Dynamics

Enable teams to evolve their own dynamics with changes in the team composition, situation, and task.

Semi-automatically assess the effectiveness of a team's process during a task.

Monitor team interactions and automatically suggest suitable processes to support a team's composition, task, and situation.

Adaptive Team Dynamics

- Focus of commercial development
  - workflow scripting languages tied to groupware repositories
  - initial research on workflow among mobile teams
- Focus of other DARPA programs
  - need automated support for adjusting workflow in response to changing situations (JFACC)
- Focus of IC&V program
  - develop meta-rule system (rules for changing the rules) that allows a team to evolve their own process model over time in response to changing team composition, situation, and task
  - monitor team dynamics in real-time to detect when the current process model is becoming ineffective
  - suggest automatically appropriate process models based upon team composition, situation, and task

Technology for Adaptive Team Dynamics

Meta-Rule Knowledge Base

Team Process Model Base

Knowledge Based Process Model Suggestor

TeamHistory

Knowledge Based Process Model Evaluator

Team State

Vision for Active, Role-based Views

Beyond shared whiteboard.

An Active Element in Role-based View

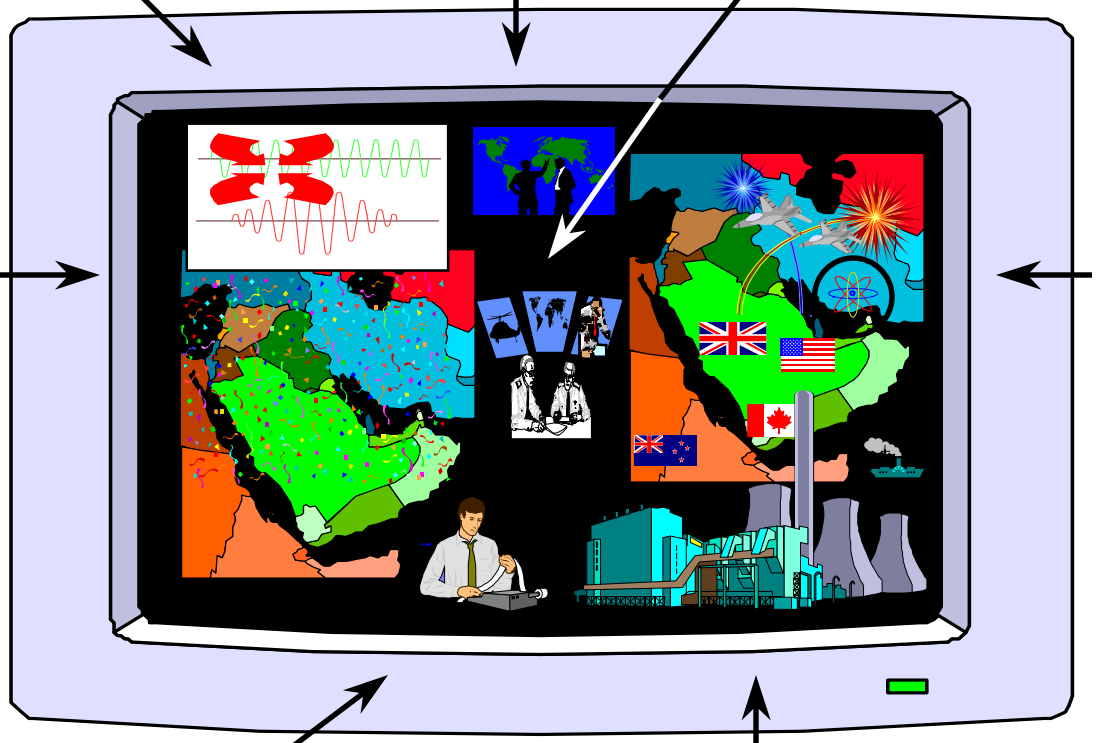
Store Video of Mission Assignment

Live Video of Mission Planning Team

Role-based Active View in Shared Situation

Shared Control of Time Varying Visualizations

Active Elements Shareable across Views



Live Video of Role-based Consultant

An Active Element in Shared View

Active, Role-Based Views

- Focus of commercial development
  - shared interaction in 3-D virtual reality views
  - shared control of single user applications
  - synchronized control of browsers
  - shared application views using embedded or linked application objects and application servers
- Focus of other DARPA programs
  - develop role-based application views from a shared schema (JTF)
  - visualization and data manipulation environments (ALP from IC&V)
  - automatic, dynamic graph creation, coordinated with automatic explanations (ALP from IC&V)
  - time-controlled viewing of simulation outputs (ALP from IC&V)
- Focus of IC&V program
  - knowledge-based generation of combined graphs and explanations
  - shareable, active, role-based views from visual micro-objects
  - shared control of replicated, time-aware, self-rendering objects

Technology for Active, Role-based Views

Visage

Distributed, Active View Coordination Protocol

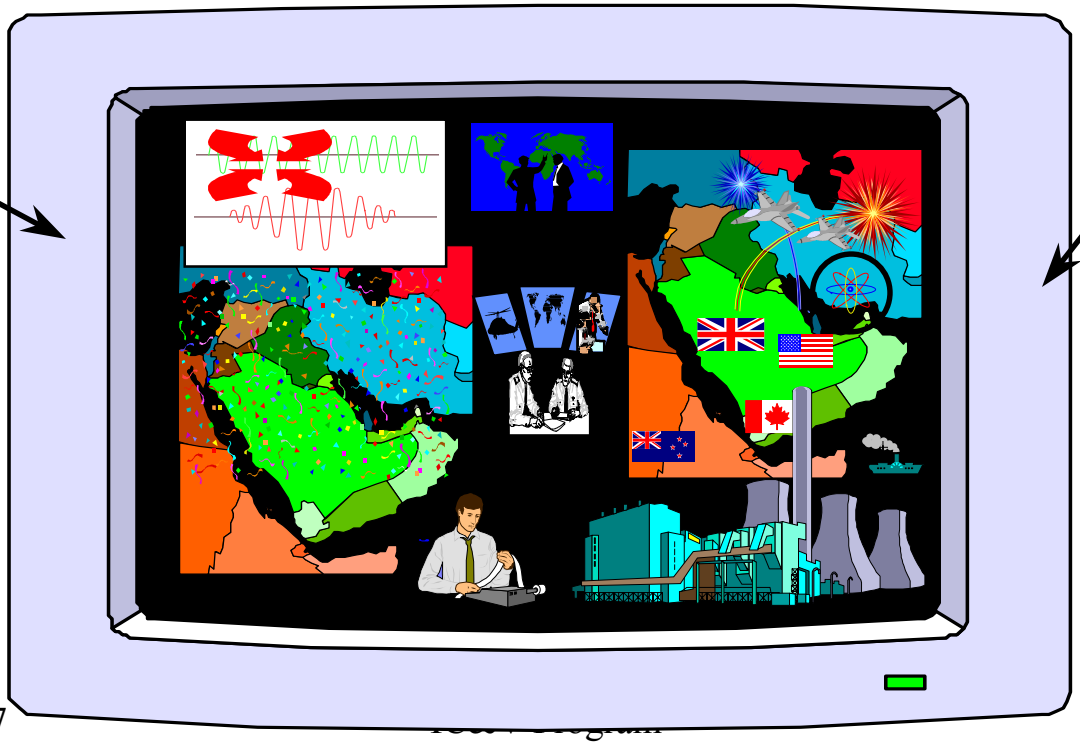
Multicast Session Coordination Bus Protocol

Scalable Reliable Multicast

Time-Aware Self-Rendering Objects

Visage Link

Active Board



Review

- Military operations have entered a new era of uncertainty, requiring agility, rapid response, and innovative team work
- Information technology in support of adaptive teams can provide a critical discriminator for the U.S. military
- Numerous DoD programs seek to exploit such technology by:
  - using commercial products (e.g., JTF use of multi-media conferencing tools)
  - developing special purpose applications (e.g., JTF Map Server)
  _ adopting DARPA/ITO technology (e.g., ALP and Visage; JFACC and CVW)
- Commercial information technology products based on standards provide key leverage for DARPA technology transition (e.g., Java, HTML, HTTP, VRML)
- DoD information systems pipeline provides multiple insertion points for DARPA/ITO collaboration and visualization technology (e.g., JTF, JFACC, ALP, AITS, LES, COE)